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ABSTRACT

Formula budgeting for college and university facilities maintenance is recommended because: (1) formulas inject objectivity into the budgeting process by using quantified data; (2) formulas tend to improve the equitability of treatment of comparable institutions; (3) formulas are intended to provide adequate but economical budgets; and (4) formulas are an efficient means of budgeting comparable units, permitting greater attention to be paid to noncomparable budget elements. This form of budgeting is proposed to address two parts of the maintenance issue: the maintenance deficit or backlog as well as an increase in annual maintenance budgets to eliminate further deficits. At the most basic level, the budget formula can provide a plan agreeable to both requestor and appropriator. A formula can be considered good if it is simple, flexible, sensitive to changing conditions, based on reasonable and adequate data, and does the job intended. Formulas or budget models used in Oklahoma, Texas, Florida, Washington State, Maryland, Colorado, Georgia, and California are profiled, including information on source documents, formula construction and elements, and policies and procedures. The fall 1979 issue of the Association for Institutional Research's "AIR Professional File" on formula budgeting by Francis M. Gross is appended. (MSE)

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FORMULA BUDGETING:

An Approach to Facilities Funding

By David L. McClintock
Assistant to the Vice President for Finance
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FOREWORD

The tightening finances of the '80s will put a greater strain than ever on the physical plant budgets of colleges and universities. State institutions in particular will need to pay more attention to the justification of requests for appropriations.

One possible means to ensure that maintenance continues to receive adequate financing is formula budgeting. Formula budgeting has been defined as the application of predetermined average cost rates or staffing ratios to quantifiable institutional program measures (such as enrollment or square feet of building space) in order to calculate the dollar resource requirements for facilities for a future year. (See Appendix, "Formula Budgeting and the Financing of Public Higher Education: Panacea or Nemesis for the 1980s?" by Francis M. Gross of the University of Tennessee.)

The use of formulas to develop institutional appropriation requests has been the subject of many inquiries to the APPA Office, from state boards of higher education and business officers, as well as from APPA member institutions. While most of the inquiries come from public institutions, private colleges and universities are also beginning to consider this funding concept.

In the past, APPA responded to these requests by providing copies of various budget formulas from its files. Then L. Terry Suber, Director of Physical Plant at Colorado State University, submitted a paper prepared by David L. McClintock, Assistant to the Vice President for Finance at CSU. His paper presents an overview of formula budgeting practices used at various times by six states to allocate funds for support of state colleges and universities. The states surveyed are Oklahoma, Texas, Florida, Washington, Maryland, and Colorado.

In Colorado, a statewide subcommittee appointed by the Colorado Association of Public College and University Presidents considered the formula work undertaken in the other five states before developing a formula that would equitably distribute physical plant resources among the public institutions of higher education in Colorado. McClintock served as chairman of this committee. This publication is an outgrowth of that review and is not intended as an exhaustive analysis of formula budgeting.

APPA's Professional Affairs Committee reviewed McClintock's paper and decided to publish it as part of a series that was inaugurated in the Fall of 1979 with the publication of Dr. Harvey H. Kaiser's Mortgaging the Future: The Cost of Deferring Maintenance.

While we believe that this publication will be of considerable interest to APPA members and others, its publication is not meant as an endorsement of the formula budgeting concept in general or of any state formula in particular. As some reviewers have pointed out, there are disadvantages to

formula budgeting. For example, one inherent danger is that the formula budgeting approach, if relied on exclusively, may ignore the many human factors that influence the distribution of resources in an organization. A good formula budget incorporates these human factors. Another problem is the non-comparability of various units that, on the surface, may appear similar. Even within a state system, there may be significant differences between one institution and another, requiring a deviation from standard formula. Budget formulas used blindly can tend to force uniformity of operation even when conformity is not in the best interest of the institution. Budget formulas do not typically recognize basic differences among institutions which may lead to different budget patterns nor do they normally allow much room for differences in management style. This argues strongly for developing as simple a formula as possible in order to minimize the number of decision variables available to budget analysts.

In addition, uniformity of data presentation within the budget process is essential. There must be absolute agreement on item definitions such as the area to be included in the "gross square foot area" of a unit or "improved land."

It should also be pointed out that budget formulas based on historical expenditure patterns will tend to perpetuate whatever inequities exist within the historical data.

With these caveats, we are pleased to present Formula Budgeting: An Approach to Facilities Funding.

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INTRODUCTION

The decline in college and university maintenance budgets during the 1970's and the concurrent growth in maintenance deficits has become a matter of national concern. The problem is frequently discussed in alarming terms and there are fears that many buildings less than 20 years old are becoming obsolete far before their expected useful life has elapsed. There have been concerns expressed that deferred maintenance may be unnecessarily endangering life and limb or that the very survival of at least some institutions may hang in the balance.

The maintenance issue must be attacked on two fronts simultaneously. The maintenance deficit or backlog must be eliminated but, at the same time, annual maintenance budgets must be increased to adequate levels in order to eliminate the increase in the maintenance deficit. Among the national organizations seeking direct solutions to the maintenance deficit problem are APPA, NACUBO, ACE, NASULGC and the Association of Governing Boards. A number of states have active programs in this area. These groups should receive our support. On the second front, a number of states have developed budget formulas which are intended to provide adequate and equitable annual budgets for the routine maintenance function.

The reasons for resorting to budget formulas are many. Among those frequently cited are:

1. Formulas inject objectivity into the budget process by using quantified data;

2. Formulas tend to improve the equitability of treatment of comparable institutions;

3. Formulas are intended to provide adequate but economical budgets;

4. Formulas are an efficient means of budgeting comparable budget units permitting greater attention to be paid to non-comparable budget elements.

At the most basic level, the budget formula can provide something that requestor and appropriator alike can agree on. A formula might be considered to be a good formula if it is simple, flexible, sensitive to changing conditions, is based on reasonable and adequate data, and does the job intended of it.

A review of a number of formulas or budget models, together with an explanation of the underlying logic or rationale for some of them, will occupy the remainder of this paper. A word of caution is in order: A number of the reports reviewed for this summary are now somewhat dated. The formulas described may have been revised to meet current conditions since the first report was published. Nevertheless, the reader should gain something of the flavor of the thought processes used to develop budget formulas and, thereby, shorten the time required to research the topic.

OKLAHOMA

Source document: "Budgeting for Maintenance Should be Based on Present Replacement Cost" by Walter W. Kraft, College and University Business, Vol. 8, No. 5, May 1950.

Kraft's landmark article on formula budgeting (first delivered in 1949 at the NAPPA annual meeting) was the result of analyses he had made over a period of 15 years or more. The basic formula is still used in Oklahoma and provides the basis for formulas developed for use at least in Texas, Washington, and Florida.

As described by Kraft, the formula provided resources only to the building maintenance function which was defined then essentially as it is now in the APPA recommended chart of accounts. Kraft observed that "(t)he uncertainty of prices of labor and material in recent years and the present high construction level have emphasized the necessity of setting up a workable, easily understood method of preparing this item for the physical plant budget." He went on to explain that "(i)n many instances buildings have been permitted to deteriorate to the point at which the repair item becomes a remodelling item. This places a great burden on the budget, is wasteful, and may encroach upon the instructional budget." Finally, he noted that "(i)t was evident that many building repairs were made in more or less temporary manner, which contributed to a more rapid deterioration of the building. Often money was allocated for building maintenance after all other money requests had been provided for."

Kraft briefly described alternative formulas for budgeting building maintenance. He dismissed methods based on gross square feet of building area or on cubic feet of building volume because of the wide variety of building types in use. He argued that the cost of maintenance will vary markedly over time and among building types so that neither area nor volume formulas could adequately take those differences into account.

Kraft went on to develop his formula for the building maintenance budget which, in its most basic configuration, may be written as follows:

Maintenance Budget = Maintenance Cost Factor X *Current Replacement Cost of the Building(s)*

Kraft identified three construction types each with its own Maintenance Cost Factor as follows:

Construction Classification	Factor
Wood-frame construction	1.75%
Masonry-wood construction	1.30%
Masonry-concrete or masonry-steel with Concrete floors	1.10%

The cost factors above were developed by Kraft as "the approximate average of our experience over a period of years." It is interesting to note that all of the formulas of this type discussed in the following pages use basically these same Cost Factors. Kraft had to resort to local construction cost indices in order to convert original building construction costs into current building replacement costs. Nowadays, one may use any one of a number of published charts or tables which provide factors to use in making the necessary conversion.

The formula *says* that the annual maintenance budget for a building should be a percentage of the current replacement cost of the building. The formula has the advantages of being relatively simple; of being broadly applicable to a variety of institutions; of incorporating an allowance for inflation automatically; and of being soundly based in easily auditable variables routinely dealt with by the physical plant department. It has the disadvantages of requiring original construction or acquisition cost data which may not be readily available; of not providing guidance about staffing levels; and of applying only to a part of the total physical plant function.

TEXAS

Source document 1: "A Formula Approach to Physical Plant Budgeting" by W. H. Badgett, Director of Physical Plant, Texas A&M University, 1964.

Statewide formulas were devised for a number of institutional budgets at the direction of the Texas State Legislature in order to promote "a

reasonable level of financing with an equitable distribution of funds among the institutions." The Texas budget formulas were intended to be scrutinized frequently and revised as experience dictated. The study committee dedicated itself to the following approach:

1. "Make a thorough study of physical plant operations at the 18 Texas schools;
2. Analyze these various operations;
3. Develop definitions for each group operation;
4. Determine those operations which might be adaptable to a formula approach;
5. Develop criteria for base formulas for those operations;
6. Test the results of the formulas recommended;
7. Support and justify the facts and findings recommended by the committee."

The committee identified the following five physical plant budget subdivisions for study:

-Building maintenance

-Custodial services

-Grounds maintenance

-Utilities

-Administration, planning and general services

In the end, the committee developed dollar formulas only for building maintenance and for custodial services. No common formula for utilities was thought possible and no basis for an administration formula was found. Data were insufficient to develop a definitive proposal for a grounds formula although the general form of one was suggested for further study.

Building Maintenance. Badgett observed that the cost of maintaining a building will vary from year to year. Large expenditures for painting,

reroofing and the like are done only infrequently. Costs also vary with intensity of use by building occupants and according to the standard of maintenance adopted by the institution. Over a period of 15 to 20 years, the average costs might be expected to "approximate a uniform maintenance cost factor for a given type of construction." The decision was to base the building maintenance formula on the current replacement cost of the building as recommended by Kraft in 1949 and 1950. Kraft's construction classification and maintenance cost factor system was adopted as published except that each of the cost factors was to be increased by 0.15 percent for air-conditioned buildings to reflect the higher cost of maintaining the added mechanical equipment. Current replacement cost for a building was to be computed by multiplying the original building cost by a factor taken from an appraisal chart published twice annually by the Markel Appraisal Chart Company. The formula was found to produce realistic and equitable building maintenance budgets for all 18 institutions. The formula was not presumed to provide for supervisory costs, other than foreman, nor was it presumed to provide for deferred maintenance and major rehabilitation projects. The formula may be stated concisely as:

1. *Current building replacement cost* = *Original building construction cost* X *Markel Chart Factor*

2. *Annual Maintenance Budget* = *Current building replacement cost* X *Maintenance Cost Factor*

Custodial Services. The study committee concluded that the custodial services budget should logically be derived from the measure of gross square feet of building space served by custodians. A number of institutions were surveyed and the results showed that the average number of gross square feet of space assigned each custodian ranged from a low of

5,000 to a high of 35,000 with two-thirds of the 90 respondents falling within a range of 11,000 to 25,000 gross square feet per custodian. The range among the 18 Texas institutions was found to be 14,000 to 20,000. The committee recommended adoption of 14,000 as a Texas standard. After analyzing prevailing salaries paid custodians and after assuming a wages-to-supplies ratio of 10 to 1, the custodial budget formula was finally reduced to one of *19¢ per gross square foot.* Budgets were prepared on this basis for a year or two and, subsequently, it was found necessary to increase the formula budget to *23¢ per gross square foot.* The formula may be stated concisely as:

1. $\text{Number of Custodial FTE's} = \frac{\text{Number of gross square feet maintained}}{14{,}000}$

2. $\text{Custodial Salary Budget} = \text{Number of Custodial FTE's} \times \text{Average Custodial Salary}$

3. $\text{Custodial Supplies Budget} = \text{Custodial Salary Budget} \times 10\%$

The two budget components may be summed and reduced to a per-square-foot measure, if desired.

Grounds Maintenance. The study committee proposed the following general form for a grounds maintenance budget formula:

$$\text{Grounds Maintenance Budget} = 0.75[A(\text{Number of intensely maintained and used acres}) + B(\text{Number of moderately maintained and used acres}) + C(\text{Number of minimally maintained and used acres})] + 0.25[D(\text{Number of FTE students}) + E(\text{Number of FTE employees})]$$

The committee left the specification of the three dollars-per-acre measures (A, B, and C), the two dollars-per-FTE measures (D and E), and the development of a rationale for the 75%/25% split as matters for future study. In words, the formula concept *says* that 75 percent of the grounds budget should

be based on the number of acres maintained and that 25 percent of the budget should depend upon the intensity of use (as measured by the total full-time campus population) of the grounds. Furthermore, the proposal would recognize that there are at least three levels of grounds maintenance (low, medium and high) each requiring different staffing levels (low, medium and high respectively).

Source document 2: "Chapter XIII: Physical Plant" taken from a report "Financing of Higher Education in Public Institutions in Texas" by Bill Thomas, Dean, School of Business Administration, Midwestern University, Wichita Falls, Texas, 1968.

This publication evaluated all the Texas budget formulas after several years of use. The author of the Physical Plant chapter appears to have had a fundamental philosophical problem with the formulas used in Texas and made a case for budget formulas having a stronger theoretical basis. His argument seems to be one of economics in which the ratio of inputs (say, dollars for maintenance) to outputs (student credit hours) should be equal in all institutions. Furthermore, the gross square feet of space per student credit hour as an input ratio should be the same for each institution as, indeed, should all other inputs. The author did not pursue the analysis very far but did point out its applicability from time to time as he proceeded with his analysis of the budget system actually in use.

Thomas observed, in general, that in spite of the formula approach the proportion of physical plant costs in total institutional appropriations had been declining or, to put the matter another way, other sectors of the institutional budget had grown faster than had the physical plant budget. Among his statistical conclusions were:

1. The distribution of physical plant costs by type (custodial, grounds, etc.) shows a definite pattern;

2. There is a reasonably high correlation between physical plant appropriations and FTE student enrollments;

3. There is almost a perfect correlation between physical plant budgets and gross square feet of building space;

4. There is a very low correlation between per-square-foot (or per-FTE-student) physical plant budgets and the absolute size of institutions which tends to argue against the premise that the larger, more complex, institutions automatically need more funds per unit of output than do the smaller ones;

5. Physical plant appropriations-per-square-foot are inversely proportionate to the size of the institution.

The author supported the latter conclusion by stating that "(g)enerally speaking, the small college must devote a larger share of its budget to functions such as general administration and general expense . . . than does a larger college or university. Certain basic . . . physical plant services must be provided regardless of the size of the enrollment and these services do not normally increase beyond the basic level in proportion to increases in enrollment." One may summarize his basic conclusions as follows:

1. The larger the FTE enrollment, the larger will be the physical plant budget;

2. The larger the number of gross square feet of space maintained, the larger will be the physical plant budget;

3. The smaller school will typically have a higher physical plant budget per gross square foot than will the larger school.

One may almost state with certainty that these basic conclusions are universally true. The author went on to analyze each of the basic physical plant budget components in more detail.

Administration and General Services. Thomas observed a high correlation

between the physical plant administration and general services budget and the total number of physical plant employees. He also observed high correlations between the total number of physical plant FTE and both FTE student enrollment and gross square feet of building space. He observed that, with a certainty of 99 percent, one could claim that:

1. 1.0 FTE physical plant employee is required for every 10,000 gross square feet of building space;
2. 148 FTE physical plant employees are required for every 10,000 FTE student enrollment; and,
3. $10,000 physical plant administration and general services budget is required for every six FTE physical plant employees.

He concluded that the appropriation for physical plant administration and general services should be computed as follows:

$$\textit{Physical Plant Administration/ General Services Budget} = \frac{\textit{Total Physical Plant FTE} \times \$10{,}000}{6}$$

Building Maintenance. In the section on building maintenance, the author observed that while Texas had been appropriating these budgets on the basis of replacement cost, there was an "almost perfect correlation between the square feet on each campus and the appropriation for building maintenance."

Custodial Services. The author generally endorsed the formula in use and previously described. He argued that perhaps it should be modified to introduce a usage intensity factor and perhaps a "clutter factor" which would reflect the number of obstacles the custodian must work around. He observed high correlation between the cost of custodial service and FTE student enrollment. He recommended the following custodial formula:

1. *Weighted Gross Square Feet* = *Actual gross square feet* X *usage factor* X *clutter factor*

2. *Custodial Budget* = *Weighted square feet* X *custodial cost factor per square foot.*

Grounds Maintenance. The author again explained that no formula existed and reiterated the need for additional data to be accumulated before one could be developed. He did note high correlations between grounds maintenance budgets and total gross square feet of building space which, to him, suggested that the area immediately adjacent to buildings requires the greatest intensity of care. He hypothesized further that the grounds maintenance budget might be highly correlated to total building circumference. Finally, he also observed high correlation between the grounds maintenance budget and FTE student enrollments.

Utilities. Thomas reaffirmed that wide disparities existed among institutions and institutional conditions. He concluded that no formula was suggested from the data but did observe high correlations between utilities costs and both FTE student enrollments and gross square feet of building space. That is, larger institutions (whether in student or gross square feet terms) use more utilities than smaller institutions on the average.

Conclusions. The author concluded that "based on past experience, square footage of building space correlates more closely with the total of physical plant appropriations than any other indicator tested." He went on to observe that while his study would indicate a Texas-wide average of $1.05 per gross square foot as the physical plant appropriation, this figure was short of the national average by a fairly wide margin and was insufficient to fund certain desirable programs. His final formula

recommendation was:

$$\text{Physical Plant Appropriation} = (\$1.25) \times (\text{gross square feet}) \times (F)$$

where

gross square feet is total area of buildings eligible for state maintenance funds; and

F is the wholesale price index (1968 = 100)

Source document 3: "Coordinating Board Recommended Formulas" taken from CB Report, Volume XIII, Number 1-2, January-February 1978.

The following is the most recent summary found for the physical plant budget formulas used in the Texas state system:

Building Maintenance.

$$\text{Building Maintenance Budget} = \text{Building replacement cost} \times \text{Maintenance cost factor}$$

where the relevant maintenance cost factors are as follows:

	Air-Conditioned	Not Air-Conditioned
Wood Frame Construction	1.90%	1.75%
Masonry-Wood Construction	1.45%	1.30%
Masonry-Concrete Construction	1.25%	1.10%

and where the building replacement cost is determined by applying the factors for the types of construction shown on Markel's Handy Appraisal Chart (published by the Markel Appraisal Chart Co., Cincinnati, Ohio 45236) to the original construction costs of each building eligible for state maintenance funding.

Grounds Maintenance.

$$\text{Grounds Maintenance Budget} = SW(0.70\ P + 122\ L + 0.50\ E)$$

where,

SW is the average hourly earnings for services for January as shown in the Survey of Current Business published by the Bureau of Economic Analysis of the U.S. Department of Commerce;

P is the total linear feet of perimeter of all campus buildings including both state and non-state supported facilities;

L is the total acres of lawns and regularly maintained areas including malls, parking lots, streets, sidewalks and so forth but excluding areas covered by buildings and excluding areas used for college farms and similar organized activities;

E is the fall semester headcount enrollment.

Custodial Services.

$$\textit{Custodial Budget} = SW \times \frac{GSF}{22,400} \times 2,080 \times 1.2$$

where,

SW is the average hourly earnings for services for January as shown in the Survey of Current Business as above;

GSF is the gross square feet of building space eligible for state funding of custodial services.

Note that the standard area assigned to each custodial FTE has increased from 14,000 to 22,400 but that the non-salary cost factor has increased from 0.1 to 0.2 as well.

Physical Plant Administration and General Services.

$$\textit{Administration and General Services Budget} = SW([FTSE + (2 \times FTEE)] \times 3.90) + (RCB \times 0.0028)$$

where,

SW is the average hourly earnings for services for January as above;

FTSE is the full-time equivalent student enrollment;

FTEE is the total full-time equivalent employees;

RCB is the replacement cost of buildings calculated for the Building Maintenance formula above.

No formulas for utilities or campus security were given in this article. For those interested, the publication also contains formulas for general administration and student services, faculty salaries, departmental operating expense, instructional administrative expense, library and organized research.

Campus Security Services.

According to recent correspondence with physical plant personnel in Texas, the following formula is being considered for use in budgeting campus security:

Campus Security Budget = $A + B$

where,

$A = SW(FTSE + FTEE) \times 4.5$, *for the first 8,000 (FTSE + FTEE) and,*

$B = SW(FTSE + FTEE) \times 3.8$, *for all (FTSE + FTEE) above 8,000.*

and where,

SW is the average hourly earnings for services for January as above;

FTSE is the full-time equivalent student enrollment;

FTEE is the total full-time equivalent employees.

The Texas system formulas have been refined considerably since first developed in the early 1960's. They provide an excellent example of the disaggregated approach where specific formulas are developed separately for each element of the physical plant budget. This can have the negative effect of reducing institutional management flexibility and forcing a common standard of performance. From the higher policy point of view, such a system of formulas can help ensure a minimum common standard of building maintenance and thereby reduce raids on maintenance budgets to prop sagging instructional and other budgets.

FLORIDA

Source document: "Budgeting Standards for Physical Plant Division Operations State University System of Florida" by Calvin C. Greene, Director, Physical Plant Division, University of Florida, 1970.

In developing a formula approach to physical plant budgets for the state universities in Florida, the Interinstitutional Physical Plant Committee of the State University System of Florida planned to "study ways of achieving greater uniformity among institutions . . . with the hope of improving equity among institutions . . ."

The committee identified four budget methods to investigate: Present budget level plus justified increases; percentage of some other budget; workload standards approach; and unit of size approach. The committee suggested that the approach of the future might well be some form of input-output analysis which would relate physical plant and other budgets to institutional output. The committee concluded that the "present level plus justified increases" approach was unacceptable because it perpetuated existing budgetary inequities and depended upon salesmanship abilities rather than on actual needs. They argued further that the approach bears no relationship to the job to be done and gives no budget guidance to new institutions. The "percentage of some other budget" approach was also rejected because its "relationship to the physical plant functions was entirely too tenuous to be viable . . . (and) too susceptible to arbitrary modification." The committee did give serious consideration to the "workload standards" approach but rejected it in the end because it is "extremely difficult to inventory and to quantify all work elements, . . . difficult to compare with other institutions and . . . is open to argument." The "unit of size" approach was selected.

The committee identified seven criteria for the final budget formulas to meet:

1. The input data must be readily obtained and readily verified;
2. The data must bear an acceptable relationship to the function to which they relate;
3. The data should lend themselves to comparison with other institutions, external to the state university system, if at all possible;
4. Because the ultimate formulas must be examined and accepted by lay persons, a complex subject must be reduced to a simple solution;
5. The results must satisfy the need of seven institutions ranging from those still in the planning stages and not yet open for students to others having enrollments of 20,000 or more students;
6. The results should provide a basis for physical plant budgeting for new and emerging institutions;
7. The results should establish staffing which, in turn, would determine salary monies required.

The committee developed five physical plant budget models.

Custodial Services. The custodial services formula is based upon gross square feet of space served by physical plant staff. The basic formula provides for custodial staffing as follows:

1 Custodial service superintendent;

1 Custodian FTE for every 12,000 gross square feet of space;

1 Custodial supervisor for every 15 custodial FTE;

1 Assistant superintendent for every 4 custodial supervisors.

Salary monies were determined by salary levels of the state personnel system. The model also allowed a custodial service expense allowance of $0.04 per gross square foot.

Administration and General Services. The administration model is based upon the gross square feet of state-supported buildings served by

the physical plant department. The minimum formula administration staffing includes:

1 Department director;

1 Assistant director;

1 Draftsman;

2 Secretaries;

1 Accounting clerk;

1 Clerk-typist.

The following additional staff are added to the basic complement as follows:

1 Assistant director at 2,000,000 gross square feet;

1 Assistant director at 4,000,000 gross square feet;

1 Engineer at 500,000 gross square feet;

1 Engineer for each additional 750,000 gross square feet;

1 Draftsman at 1,000,000 gross square feet;

1 Additional draftsman for each additional 1,000,000 gross square feet;

1 Additional FTE position for each 500,000 gross square feet.

Salary monies are determined by the state personnel system. The model also allows an administration expense budget of $0.01 per gross square foot.

Grounds Maintenance. The grounds maintenance model is based upon the gross area of all campus buildings including both state and non-state funded facilities. The basic grounds maintenance complement includes:

1 Grounds maintenance superintendent;

14 FTE groundskeepers.

For institutions having more than 500,000 total gross square feet of space, add:

1 FTE groundskeeper for each 45,000 gross square feet;

1 Groundskeeping supervisor for each 15 FTE groundskeepers;

1 Assistant superintendent for each 5 supervisors.

Salary monies are determined by the state personnel system. The model also allowed a supplies budget of from $0.025 to $0.055 per gross square foot depending upon climate, soil conditions and so forth.

Campus Security. The security model is also based upon the gross area of all campus buildings including both state and non-state funded facilities. The basic security force is as follows for institutions up to 800.000 gross square feet of space:

1 Superintendent;

10 FTE security officers of various ranks.

As the institution grows, additional positions are added as follows:

Size Range	Additional FTE
800,001 to 1,000,000 GSF	*Add 1 FTE per 80,000 GSF;*
1,000,001 to 2,000,000 GSF	*Add 1 FTE per 90,000 GSF;*
2,000,001 to 3,000,000 GSF	*Add 1 FTE per 100,000 GSF;*
3,000,001 to 4,000,000 GSF	*Add 1 FTE per 110,000 GSF;*
4,000,001 to 5,000,000 GSF	*Add 1 FTE per 120,000 GSF;*
5,000,001 to 6,000,000 GSF	*Add 1 FTE per 130,000 GSF;*
6,000,001 to 7,000,000 GSF	*Add 1 FTE per 140,000 GSF;*
7,000,001 and up GSF	*Add 1 FTE per 150,000 GSF.*

Salary monies are determined by the state personnel system. The model also allows an expense budget of $0.006 per gross square foot.

Building Maintenance. Florida adopted exactly the same building replacement cost approach to building maintenance budgeting used in Texas.

The author concluded by stating that the formula had been well

accepted in Florida. He observed that the formula was funded at 92 percent in 1969-70 and at 94 percent in 1970-71. It is interesting to note that the Florida formulas implicitly recognize that relatively larger physical plant staffs are required by the smaller institutions and that economies of scale are obtained at the larger ones. The Florida formulas have the advantage of giving specific guidance about staffing patterns and organization in four areas of physical plant responsibility.

WASHINGTON

Source document: "A Model Budget Analysis System for Plant Operation and Maintenance" by Denis J. Curry, Director, Office of Interinstitutional Business Studies, The Evergreen State College, Olympia, Washington, 1970.

The formula budget approach was initiated by the presidents of the six four-year institutions in Washington State in order to "facilitate the analysis and comparison of the plant operation and maintenance program at the six colleges and universities." Seven major functions were included in the definition of plant operations:

1. Building Maintenance
2. Janitorial Services
3. Grounds Maintenance
4. Utilities
5. Administration
6. Police, Fire and Safety
7. Refuse Disposal and Trucking

Formulas were developed for the first four functions listed.

The committee defended the use of formulas on three grounds: "First, each formula is designed to apply reasonable standards to each function or activity. Second, the use of formulae enables each institution to determine its relative position with respect to each formula item and to adjust its allocation of funds accordingly. Third, the formulae make it

possible to compare operating budget allocations for plant operations and maintenance among the four-year institutions of higher education."

The committee went on to assert that "(c)ontinued budget allocation below formula levels will, however, inevitably result in serious sacrifices to safety, security, sanitation and support services for the institution's instruction, research and service activities." They concluded that sub-standard maintenance results in the "acceleration of depreciation and deterioration requiring costly repairs."

Building Maintenance. The committee rejected a building maintenance formula which has a gross square footage base because:

1. "The facilities of a typical college or university include warehouses, temporary structures and other buildings constructed at times when lighting and ventilation standards were lower than those now in effect;
2. The use of a composite cost per square foot to determine future requirements assumes that the levels (of maintenance) adequate for the existing structures are appropriate for new space. This assumption is inaccurate since maintenance costs are higher for new construction which contains complex mechanical, electrical and ventilation facilities;
3. The use of historical square foot costs assumes the adequacy of present allocations;
4. There is no built-in safeguard against inflationary costs; and
5. Due to the difference in the mix of age and type of buildings, no standard for interinstitutional comparison is provided."

The committee went on to recommend the same building replacement cost

approach first proposed by Kraft and subsequently adopted in Texas and Florida. They used the same three building types together with the same six maintenance cost factors used in Texas and Florida. The Washington formula defined the initial acquisition cost of a building as follows:

"In order to obtain consistency in procedures followed to compute the current replacement cost of buildings, construction and acquisition costs are defined as follows:

1. The full construction costs of a building include: Basic construction contract costs, utility and site costs to a point 5 feet outside the building, architectural and engineering expenses, professional service costs, project supervision and other on-site inspection service costs such as surveys, test boring, etc., and fixed equipment.
2. Full acquisition costs including legal fees, etc."

Custodial Services. While the committee agreed that "(a)though 15,000 gross square feet per janitor would permit the achievement of an optimum standard" they adopted a standard of 20,000 gross square feet as acceptable provided an additional allowance was made for supervisors and relief staff to fill places of janitors temporarily absent from work. The formula adopted is as follows:

1. *Allow 1.0 FTE janitor for every 20,000 gross square feet of space maintained;*
2. *Allow 1.0 FTE window washer for every 350,000 gross square feet of space maintained;*
3. *Multiply the positions computed in (1) and (2) above by 1.1375 to provide 1.0 FTE relief worker for every 12 formula FTE and to provide 1.0 FTE supervisor for every 20 FTE employees.*
4. *Compute janitorial salaries budget by multiplying the result of (3) above by the "average man year cost."*

5. *A supplies budget was determined from the base year of the formula on a per FTE basis and adjusted upwards for inflation in subsequent years.*

6. *An allowance for equipment replacement was computed by allowing $0.0092 per gross square foot maintained per year.*

Grounds Maintenance. The committee based its grounds formula upon an analysis of the types of landscaping to be maintained. They identified four types each with its own manpower standard:

1. *Very High Intensity Landscaping. Allow 1.0 FTE for every four acres to maintain highly refined planting areas adjacent to structures, plazas, campus entrances and the like;*

2. *High Intensity Landscaping. Allow 1.0 FTE for every eight acres of improved areas having unsprinklered and a high incidence of shrubs and trees;*

3. *Medium Intensity Landscaping. Allow 1.0 FTE for every 16 acres of improved areas having sprinklered lawns and a low incidence of shrubs and trees. This classification also includes roads, walks and other paved areas.*

4. *Low Intensity Landscaping. Allow 1.0 FTE for every 32 acres of all general areas in a wild or natural state and those with limited improvements where maintenance methods are simple and less frequent attention is required.*

5. *Multiply the positions computed in (1), (2), (3), and (4) above by 1.1375 to provide 1.0 FTE relief worker for every 12 formula FTE and to provide 1.0 FTE supervisor for every 20 FTE employees.*

6. *Compute the grounds maintenance salary budget by multiplying the result of (5) above by the "average man year cost."*

7. *A supplies budget was computed as "a factor of 10 percent of the building maintenance allowance."*

A utilities formula was also developed but, since it presupposed fairly static energy costs, it is not generally applicable. No formulas for physical plant administration, security, and other general services were proposed since these were considered to be "noncomparable elements."

MARYLAND

Source document: "Formula Budgeting for Physical Plants of Universities and Colleges" by George O. Weber, Director, Physical Plant Department, and William H. Horsey, Planning Engineer, University of Maryland, 1972.

This new approach to formula budgeting was also well described by E. W. Johnson in his March, 1978, APPA Technical Paper entitled "Physical Plant Financial Administration for Small Schools."

The stated purpose of Weber's report was "to develop a formula for determination of the annual operating and maintenance budget required to efficiently perform specifically identified physical plant functions within a university or college regardless of the size, composition or location of the institution." The authors went on to identify a list of physical plant functions similar to those presented elsewhere but concluded that formula budgeting is appropriate only for administration, building maintenance, custodial services, and grounds maintenance. All other department functions were considered not to be amenable to formula budgeting.

The authors identified the following basic assumptions which are key to the formula they developed in the article:

1. The four physical plant functions listed above and to which the formulas are to be applied are presumed to be performed by in-house personnel. If part or all of the functions are contracted, the formula results must be adjusted.
2. It is assumed that the proportions of expenditures for labor and materials are fairly typical across institutions.
3. It is assumed that the general mix of buildings at institutions of higher education are uniformly susceptible to a formula approach.

4. It is assumed that the unique effects of geography and climate tend to equalize.
5. The institution is assumed to be open for business 45 hours per week as a norm. The basic formula results must be modified for longer or shorter standard work weeks.
6. It is assumed that, as a norm, an institution provides 190 gross square feet of space per full-time equivalent student. The basic formula results must be adjusted for larger or smaller space standards.
7. It is assumed, as a norm, that the institution has a building-to-land coverage ratio of 0.25; that is, 25 percent of the total developed campus area is covered by buildings and the rest is landscaped in the broadest interpretation of the word. Again, the basic formula results must be modified for different coverage ratios.

The basic budget formula for the four physical plant functions described above is based upon gross square feet of space maintained by the physical plant department. The minimum basic formula budget is given by:

1. $FTE = \frac{GSF}{10,000}$.

2. $\begin{matrix}\textit{Annual budget for} \\ \textit{4 Basic Functions}\end{matrix} = FTE \times S \times MSF$

The optimum basic budget is given by:

1. $FTE = \frac{GSF}{8,000}$

2. $\begin{matrix}\textit{Annual Budget for} \\ \textit{4 Basic Functions}\end{matrix} = FTE \times S \times MSF$

where, in either case,

GSF is number of gross square feet of space operated and maintained by the physical plant department;

FTE is the number of FTE physical plant employees required to perform the four basic physical plant functions;

S is the average annual salary and benefits;

MSF is a factor for computing the materials and supplies component of the physical plant budget measured as a percentage of the total salaries and wages budget.

The 8,000 and 10,000 gross square feet factors were not justified in the report although the authors did say that "the greater the productivity of labor, the larger the divisor can be." The basic budget resulting from the foregoing is adjusted upward or downward by three graph factors relating to "hours of operation," "intensity of use," and "intensity of landscape development." Graphs for each of these were included in the report and the appropriate correction factors were intended to be read directly from them. For those readers interested in pursuing the Maryland model in greater detail, equations for the graph factors used in the paper can be expressed more or less accurately in the following algebraic forms:

Hours of Operation Curve

$Multiplier = 0.03H = 0.00023H^2 + 0.017 \log H + 0.0000006H^3$

where H is Hours of Use per Week and $\log$ is the natural log function.

NOTE: The multiplier = 1.00 when H = 45 hours per week.

Intensity of Use Line

$Multiplier = 1.285 - 0.0015\ G$

where G is the number of gross square feet per FTE student.

NOTE: The multiplier = 1.00 when G = 190.

Intensity of Landscape Development Line

$Multiplier = 0.75 + L$

where L = decimal fraction of land covered by buildings.

NOTE: The multiplier = 1.00 when L = 0.25.

These equations may, of course, be adjusted to suit individual institutional or system needs. The specific adjustment factors used here relate back to the basic assumptions made. If, for example, the institution is open longer than 45 hours per week as a norm, then the basic formula results are increased according to the graph factor. If the institution has more than 190 gross square feet of space per FTE student, then the basic formula result would be decreased. Finally, if the institution has a building-to-land coverage ratio larger than 0.25, the formula results must be increased. If the basic assumptions are changed, then new adjustment curves must be devised in those terms.

The following steps may be followed to apply the formula:

1. Compute formula FTE staff using either the minimal or optimal basic formulas above;
2. Adjust the basic FTE formula staff result for Hours of Operation and for Intensity of Use;
3. Divide the total adjusted FTE result into the four functional categories on the following basis:

-Administration	5%
-Building Maintenance	25%
-Grounds Maintenance	10%
-Custodial Services	60%

4. Adjust the grounds maintenance FTE result for Intensity of Landscape development;
5. Convert each FTE result to salary dollars by multiplying FTE by the appropriate average annual salaries and benefits number of each group;
6. Compute the budget for materials and supplies for each group by multiplying each of the four salary budgets computed in step 5 by

the following supply factors:

Administration	8/92	=	0.087
Building Maintenance	30/70	=	0.427
Grounds Maintenance	30/70	=	0.429
Custodial Services	10/90	=	0.111

NOTE: The implication of these factors is, as an example, that of the total expenditure on custodial services, 90 percent is spent on salaries and 10 percent is spent on janitorial supplies and other non-salary costs.

The sum of the four salary budgets and the four supplies budgets computed above yield the total budget for the four basic physical plant functions to which the formula applies. To this result must still be added budgets for utilities, security, and all other physical plant functions not specifically covered by the formula.

While somewhat cumbersome to present, the formula is relatively simple to use, has inflation automatically built into it if current or expected future salary levels are used, and requires a bare minimum of input data. It is also easily modified to fit local budget constraints.

COLORADO

Source document: "Colorado Association of Public College and University Presidents Formula Financing Committee: Final Report of the Physical Plant Subcommittee on Operations and Maintenance" by D. L. McClintock, Subcommittee Chairman and Assistant to the Vice President for Finance, Colorado State University, 1979.

The Colorado physical plant operations and maintenance formula was developed by a statewide committee appointed by the presidents of the state-supported institutions of higher education. The task was only part of an ongoing formula financing project which is simultaneously studying formulas for a number of institutional activities. The participating institutions include six universities or university campuses, six four-year colleges and nine community colleges.

The formula developed for Colorado applies only to ongoing or routine physical plant operations and maintenance which is defined to be those costs included in the APPA Classification of Accounts for Physical Plant but *excluding* the costs of purchased utilities, *excluding* replacement costs of departmental equipment, *excluding* the costs of Major Repairs and Renovations (Special Line Items) and *including* the costs of operating and maintaining utility generating and distribution systems. Routine Operations and Maintenance is taken to include the costs of physical plant administration (including campus environmental health and life safety programs), building and equipment maintenance, custodial services, utilities generation and distribution, and grounds maintenance all as defined by APPA. It also includes the following Other Services: Campus Security, Property Insurance, Bus Systems (unless self-supporting), Fire Protection, Safety, Solid Waste Disposal, and Trucking and Moving.

The committee was directed to develop budget formulas which would "equitably distribute physical plant resources among the public institutions of higher education." The committee was further directed to establish a base year from which all formula calculations would proceed and such that the formula would allocate the same resources to that base year as were actually provided statewide. The formula was, from the outset, not to generate ideal budgets in any sense of the word. The committee established the following additional criteria for the formulas to meet:

1. *The input data must be easily obtained and readily verified by audit;*
2. *The input data must bear an acceptable and logical relationship to the functions of the physical plant;*
3. *The input data should lend themselves well to interinstitutional comparisons;*

4. *The formula must be as simple as possible in order to be easily understood;*

5. *The formula must produce unambiguous results which satisfy the needs of a variety of state-supported institutions of higher education;*

6. *The formula should provide a logical basis for staffing and budgeting new or emerging institutions;*

The committee selected fiscal year 1973-74 as the formula base year. While the oil embargo took place in the fall of 1973, its effects on Colorado maintenance budgets for that year were modest. Nevertheless, whatever budget inadequacies existed in 1973-74 will necessarily be perpetuated in future years.

The committee relied heavily on formula work already undertaken in Oklahoma, Texas, Maryland, Florida and Washington and concluded that all these approaches had at least some undesirable aspects. None of the formulas studied actually encompassed all physical plant functions. The formulas which relied on the replacement cost approach were felt to require inordinate amounts of input data. While a number of formula reports gave lists of reasons for rejecting a maintenance formula founded on gross square feet, most authors agreed that nearly perfect correlations exist between maintenance budgets and gross square feet of space. The Maryland approach was investigated in depth but, in the end, it was rejected because it allocated the same staffing per square foot to both large and small institutions when scale problems are known to exist. Most of the earlier formulas typically utilized a disaggregated approach in that separate formulas were developed for each physical plant function which may unnecessarily restrict variation in institutional policy and management. In the end, the Colorado group chose to follow a highly aggregated approach with

a minimum of easily audited input data and with formula results that give the individual institutions maximum policy and management flexibility. It was also recognized that statistical correlations have drawbacks; they do not necessarily describe a cause-and-effect relationship. For example, statistics will demonstrate that the physical plant budget is highly correlated both to gross square feet of space and to FTE student enrollment. The obvious reason for this is that gross square feet of space is highly correlated to FTE student enrollment. The large institutions have large enrollments and vice versa. For a specific institution, the replacement value approach is probably no more than a roundabout way of budgeting maintenance on a per-square-foot basis. An inflation factor is implicitly incorporated into the formula within the replacement value number instead of explicitly as some sort of price index. Otherwise the maintenance cost factors for the three types of space are constant. Thus, the only critical element in the replacement cost analysis is the classification of construction types. This latter will be significant only if an institution's average mix of the three types departs markedly from a local or national average mix. There is great uniformity of construction types in Colorado and the classification system was not considered to be significant to include explicitly in the analysis.

In the end, the committee concluded that the single input variable most closely related to the physical plant mission is size: The larger the institution, the more physical plant resources are required to operate and maintain it. The correlation between measures of gross square feet of space and physical plant FTE employees for 1973-74 Colorado data was 0.995 or nearly perfect. State-supported gross square feet of space is reported

annually by all institutions using WICHE guidelines adopted by the Colorado Commission on Higher Education and is subject to audit. A second important factor is a measure of the intensity with which space is utilized. Intuitively, the harder and longer a building of a given size is used per day, the higher should be maintenance costs to preserve the building from deterioration. One common measure of intensity of use is hours-per-day of operation; another is the number of persons occupying and using a building in a given time period. The committee elected to use gross square feet of space per full-time equivalent student (GSF per FTSE) as a measure of intensity of use. The lower this number is, the heavier is the utilization and vice versa.

The Physical Plant Operations and Maintenance Formula recommended by the committee may be summarized as follows:

1. *Workload Standard = 8,500 + 0.001 (Gross Square Feet)*

2. $$\textit{Basic Formula FTE} = \frac{\textit{Gross Square Feet}}{8{,}500 + 0.001\ (\textit{Gross Square Feet})}$$

3. *Adjustment Factor = 1.25 - 0.0025 (GSF/FTSE), for GSF/FTSE less than 100;*

   Adjustment Factor = 1.00, for GSF/FTSE larger than 100.

4. *Adjusted Formula FTE = (Basic Formula FTE) X (Adjustment Factor)*

5. *Unit Budget = (Unit Budget from Prior Year) X (Inflation Factor)*

6. *Formula Dollar Budget = (Adjusted Formula FTE) X (Unit Budget)*

It was observed that salaries, wages and benefits formed a stable 72 percent of the total physical plant operations and maintenance budget over the years under study. This permits annual development of separate inflation factors for the two major components of the Unit Budget. That is, a materials and supplies inflation factor may be applied to 28 percent of

the Unit Budget while a different inflation factor may be applied to the 72 percent salaries, wages and benefits component if there have been, or are expected to be, differential price movements.

The formula generated the same staffing levels and dollar budgets as were actually appropriated statewide in 1973-74. There was necessarily some redistribution of the base year resources because the formula is not an exact model of the 1973-74 expenditure pattern; redistribution was primarily towards the smaller institutions away from the larger ones but was negligible overall. In 1973-74, there was one physical plant FTE for every 10,200 gross square feet of space in Colorado. This measure was 12,142 gross square feet per FTE in 1976-77 and was 11,424 in 1978-79. The formula provides essentially one FTE for every 10,200 gross square feet overall but, by incorporation of the scale factor, staffing is provided on the basis of one FTE for every 8,500 gross square feet at a very small school while a large university of four million gross square feet would be staffed on the basis of one FTE for every 12,500 gross square feet. The formula does not specify how the FTE will be allocated to the individual physical plant functions.

Certain urban institutions are utilized very heavily. They may be open for classes 12 to 18 hours per day and have such heavy enrollments that there are less than 100 gross square feet of space per FTE student, often less than 60 gross square feet per student. The Colorado formula recognizes the special maintenance needs of such institutions by providing 10 percent more staff if the institution has only 60 gross square feet of space per student and by providing 5 percent more staff to institutions having 80 gross square feet per student. No additional staff are provided

those institutions having at least 100 gross square feet per FTE student although this standard is far below the 190 norm used in Maryland. The added staff are typically required for increased custodial and security workloads.

A statewide average unit budget was used to generate dollar budgets from FTE staffing allotments. Since salary levels are established centrally by the State Department of Personnel, very little participation by the institutions is typically possible although proposals concerning the magnitude of the inflation factor for materials and supplies may certainly be made collectively by the institutions.

The formula does generate a reasonable level of maintenance support on an equitable basis. The formula has the benefits of being easily articulated to laypersons and of being easily modified to generate richer or leaner budgets to meet changing appropriations climates.

GEORGIA

Source document: "Report of the Plant Operations Study Team of the Regents' Request Formula Revision Committee" by Jacob H. Wamsley, Chairman, 1972.

The Regents of the University System of Georgia adopted an interesting formula for use in developing the budget request submitted to the Georgia State Legislature. The operations and maintenance formula develops a budget request for the routine ongoing physical plant mission including custodial service, campus security, building and equipment maintenance, purchased utilities, grounds maintenance, preventive maintenance and so forth. The formula excluded major repairs and replacement costs.

The formula procedure and the University accounting system recognize

five major physical plant cost centers each having two or more objects of expenditure. These are:

Physical Plant Supervision
- Personal Services
- Operating Expense

Building Maintenance
- Personal Services
- Utilities
- Operating Expense

Custodial Services
- Personal Services
- Operating Expense

Grounds Maintenance
- Personal Services
- Operating Expense

Campus Security
- Personal Services
- Operating Expense

Thus, historical cost data are readily available for eleven separate expenditure classifications which sum to the total physical plant operations and maintenance expenditure. The University system also measures state-supported gross square feet of building space in a conventional manner so that each of the eleven cost measures may be reduced to a measure of cost per gross square foot of space all of which sum to the total physical plant cost per gross square foot of state-supported space.

The basic operations and maintenance formula for the budget request may be summarized very simply as follows:

$$\textit{Request} = \begin{array}{l}\textit{Number of State-}\\ \textit{Supported Gross}\\ \textit{Square Feet}\end{array} \times \begin{array}{l}\textit{Projected Cost Per}\\ \textit{Gross Square Foot}\\ \textit{for Maintenance}\\ \textit{and Operation of}\\ \textit{the Physical Plant}\end{array}$$

That is, the total gross square feet of space estimated to be on line in the budget request year for the entire University System of Georgia is

multiplied by the system-wide estimated average cost per gross square foot to operate and maintain space in the budget request year.

To compute the request year gross square footage, the following calculation (very typical of that used by most institutions across the country) is made from space inventory data for the system:

Number of State-Supported Gross Square Feet in the Request Year = *ACTUAL state-supported gross square feet in place at the last space inventory.*

PLUS

ACTUAL state-supported gross square feet added since the last space inventory.

PLUS

ESTIMATED state-supported gross square feet to be placed in service prior to the beginning of the fiscal year for which the budget request is made.

PLUS

ESTIMATED state-supported gross square feet to be added during the request fiscal year. X $\frac{\textit{Number of months the new space will be in service}}{12}$

In short, if a new building will be on line for six months of the request fiscal year, then only half the space is added to the gross square footage used in the formula and the balance is added the following year.

The actual cost per state-supported gross square foot in the base fiscal year is displayed as follows:

Actual Cost per State-Supported Gross Square Foot = *Administrative salary costs per gross square foot*

PLUS

Building maintenance salary costs per gross square foot

PLUS

Custodial salary costs per gross square foot

PLUS

Grounds maintenance salary costs per gross square foot

PLUS

Security salary costs per gross square foot

PLUS

Administrative operating expense per gross square foot

PLUS

Building maintenance operating expense per gross square foot

PLUS

Custodial operating expense per gross square foot

PLUS

Grounds operating expense per gross square foot

PLUS

Security operating expense per gross square foot

PLUS

Utilities cost per gross square foot

Each of the 11 actual cost figures must be increased to reflect the estimated unit costs in the request fiscal year. This may be displayed for illustrative purposes as follows:

Request Year Budget Request Factors	=	*Salary Actual Cost per Gross Square Foot*	X *Expected Increase in Average Salaries for Request Fiscal Year*

OR

Operating Expense Actual Cost per Gross Square Foot		X	*Expected Increase in Price Level of Supplies etc. for Request Fiscal Year*

OR

Utilities Actual Cost per Gross Square Foot		X	*Expected Increase in Price of Utilities for Request Fiscal Year*

The result of the foregoing analysis is a request year measure of the state-supported gross square feet in the system to be maintained with state funds together with a projected average cost per gross square foot to do so. The result of multiplying the two together yields the physical plant budget request for the fiscal year in question. The Georgia State Legislature is free to fund the request in full or at some percentage more or less than full. Once the budget is appropriated, the Regents of the University System are presumably free to apportion physical plant budgets among the institutions based upon factors other than those used in the formula as necessary.

It will be immediately observed that the formula is silent on numbers of staff required to perform the functions of the physical plant. If the basic formula is used to determine institutional budgets, then the formula does not incorporate a scale factor. The Regents themselves may, of course, recognize scale factors and other special considerations in making their budget allocations. This formula would seem to maximize policy flexibility for the Regents.

CALIFORNIA

Source document: "Budget Formulas and Standards Manual" by the Budget Planning and Administration Department, Chancellor's Office, The California State University and Colleges, Los Angeles, California, 1974.

The California State University and Colleges system has adopted a comprehensive set of budget formulas and standards which are published in looseleaf form and which are updated regularly. The approach used is essentially one of standardized workloads with special consideration given to unique situations. The basic physical plant formulas used at the date of publication may be summarized as follows.

Campus Security. Staffing is determined by the size of the headcount enrollment, by the gross square feet of building space and by the number of acres available to the institution. The minimum security force is defined to be 6.0 FTE regardless of size. Security officer positions are determined as follows (including 1.0 FTE Supervisor):

Allow 1.0 FTE for every 2,000 headcount enrollment for the first 10,000 headcount students;

Allow 1.0 FTE for every 3,000 headcount enrollment for headcount students above the first 10,000;

Allow 1.0 FTE for every 700,000 gross square feet of state-supported space, rounded to the next whole number;

Allow 1.0 FTE for every 150 acres (including both improved and unimproved) up to a maximum of 2.0 FTE.

Campus security clerical positions are determined as follows:

Allow 0.5 FTE for headcount enrollments up to 10,000 students;

Allow 1.0 FTE for headcount enrollments above 10,000.

Physical Plant Administration. The provision of staff to the administrative function may be summarized as follows:

Allow 1.0 FTE chief of plant operations;

Allow 1.0 FTE additional professional position at 1,150,000 gross square feet;

Allow 1.0 FTE additional professional position at 2,300,000 gross square feet;

Allow 1.0 FTE drafting aide;

Allow 1.0 FTE secretary for each professional position;

Allow 0.22 FTE office administration positions for each 100,000 gross square feet of state-supported space.

Utility Plants. Utility system staffing is determined as follows:

Allow 1.0 FTE chief engineer per campus;

Allow 4.0 FTE technical craftsman positions as a basic complement;

Allow 1.0 FTE additional technical craftsman position if the campus has a central plant;

Allow 1.0 FTE additional technical craftsman positions for each 250,000 gross square feet of state-supported space.

Building Maintenance. Building maintenance staffing is determined by the number of gross square feet of state-supported space as follows:

Allow building maintenance technical craftsman FTE as follows--

$$0.55\left(\frac{\text{Gross Square Feet}}{53,700} + 5.8\right)$$

Allow unskilled and semi-skilled FTE as follows--

$$0.30\left(\frac{\text{Gross Square Feet}}{53,700} + 5.8\right)$$

Allow other FTE as follows--

$$0.15\left(\frac{\text{Gross Square Feet}}{53,700} + 5.8\right)$$

This formula provides building maintenance staffing at the rate of 5.8 FTE plus 1.0 additional FTE for every 53,700 gross square feet of state-supported space. The basic formula staff is budgeted as 55 percent craftsmen, 30 percent skilled and semi-skilled workers, and 15 percent other positions.

Grounds Maintenance. Grounds maintenance staffing is determined by the number of acres to be maintained and the headcount student enrollment.

Allow 1.0 FTE supervisor per campus;

Allow 3.5 FTE groundsmen as a basic complement;

Allow 1.0 FTE additional groundsmen for every 10.5 improved acres;

Allow 1.0 FTE additional groundsman for every 55 unimproved acres;

Allow 1.0 FTE additional groundsman for every 22,500 headcount students but adjusted as follows--

$$\text{Grounds FTE} = \frac{\text{Headcount enrollment}}{22,500} \times \frac{\text{Headcount enrollment}}{100 \times \text{number of improved acres}}$$

Allow 1.0 FTE additional groundsman for every 12.0 FTE groundsmen computed above to allow for sick leave and vacation coverage at the rate of 1.0 FTE for every 12 regular employees.

The budget model allows additional grounds staff where there are very large enrollments. However, the effect of the adjustment is reduced considerably when the number of improved acres accommodating the enrollment is correspondingly large.

Custodial Service. Custodial staffing is determined by gross square feet of space maintained and by headcount student enrollment.

Allow 1.0 chief of custodial services for each campus;

Allow 1.0 FTE custodial supervisor for each 20.0 FTE custodians;

Allow 1.0 FTE custodian for every 15,870 gross square feet of state-supported uncarpeted space;

Allow 1.0 FTE custodian for every 20,000 gross square feet of state-supported carpeted space;

Allow supplementary FTE (minimum of 2.0 FTE) for day coverage computed as follows:

$$FTE = \frac{\text{Headcount enrollment}}{2,180} \times \frac{\text{Headcount enrollment} \times 75}{\text{State-supported gross square feet}}$$

Allow 1.0 FTE custodian additional for every 12.0 FTE custodians computed above to provide for sick leave and vacation coverage.

CONCLUSION

A variety of physical plant budget formulas and models are available. They range from relatively simple, highly aggregated formulas to complex, detailed and quite disaggregated models. The formulas presently in use serve a variety of purposes: Some have originated within the higher education community as a means to unify the budget request process behind a common strategy. Others have been imposed upon higher education by

governing boards, by state executive branches or by state legislatures. Ideally, the formula will be acceptable to all sectors and will result in adequate and equitable levels of maintenance. Circumstances of the specific situation will dictate the type of formula selected. Whatever formula is chosen, it should have the following characteristics:

1. The formula should inject objectivity into the budget process;
2. The formula should improve or maintain the equitability of treatment of all participating institutions;
3. The formula should provide demonstrably adequate, but economical, budget levels;
4. The formula process should be as simple as possible so that it can easily be presented to laypersons;
5. The formula should use quantifiable input data which are easily obtained (by even the smallest participating institution) and which can be easily audited;
6. The input data should bear an acceptable and logical relationship to the physical plant function;
7. Both the input data and the formula results should lend themselves to ready comparison with other institutions both internal and external to the system;
8. The formula should precisely define those university functions and costs to which the formula allocates resources;
9. The formula process should preserve institutional management flexibility to the maximum extent possible;
10. Finally, in this day of declining enrollments and tightening budgets, an acceptable formula must be adjustable to meet changing appropriation and budget climates.

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Appendix

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FORMULA BUDGETING AND THE FINANCING OF PUBLIC HIGHER EDUCATION: PANACEA OR NEMESIS FOR THE 1980s?

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The financing of higher education has continued to remain a sensitive issue since the first state dollar was appropriated. Consequently, college officials and legislators have explored various ways of providing for the objective and equitable distribution of state funds to higher education. In recent years, concern has centered around the viability of formula funding—a practice which has gained widespread acceptance (or, at least, utilization) during the last twenty-five years.

The Budget Formula

Technically, budget formulas are lengthy sets of statements that detail a procedure for manipulating variable data applicable to an institution of higher education, by predetermined fixed factors, to produce the future funding requirements of that particular college or university (Gross, 1973). In simple language, this means applying some predetermined average cost rates or staffing ratios to quantifiable institutional program measures (such as enrollment or square feet of building space) in order to calculate the dollar resource requirements for a future year. The use of formulas to develop institutional appropriation requests (formula budgeting) may or may not result in actual appropriations equal or related to the amounts requested (formula funding).

Budget formulas may be considered the offspring of necessity. The history of the development of public higher education spans the four great eras in which major emphasis was directed toward the development of (1) the liberal arts colleges, (2) the agriculture and mechanical institutes, or land-grant colleges, (3) the teacher training colleges, and (4) the technical and/or community colleges. Consequently, by 1970, almost every state reflected full participation in each era through the existence of institutions of each type and, in many states, multiple structures for the administration of the public higher education. Moreover, the great increase in enrollments, which began in the 1950s and did not peak until the early 1970s, encouraged most four-year and many two-year state institutions to broaden the scope of their activities: state universities and land-grant colleges became major research universities, regional teacher colleges became universities, and technical schools became community colleges. By the mid-seventies, multi-campus university systems existed which were singular in some states and dual in others. Some states chose to place four- and two-year institutions under different governing boards, others decided to put them under one single board, and still others chose to use combinations of both schemes.

Faced with a variety of state-created higher educational institutions, the failure of available state resources to keep up with growth patterns and the public demand for services, the advent of accountability and cost-effectiveness, and the ground swell of public opinion for greater equity in the appropriation of state funds among colleges and universities, it is easy to understand why many states decided to develop budget formulas to "feed the tigers." After all, as Millett (1974, pp. 11–12) pointed out, the advantages identified by formula advocates included:

1. The lessening of the political warfare among, and open lobbying by, state-supported institutions for scarce funds
2. The assurance of annual operating appropriations for institutions based on quantifiable objective measures
3. The provision to state officials of a reasonably simple and understandable basis for deciding upon the appropriation requests of individual institutions
4. The representation of a reasonable compromise between state control over line-item budgeting and institutional fiscal autonomy.

Characteristics of Budget Formulas

Although state budget formulas have evolved to reflect the collective needs of the institutions to which they apply, current formulas display certain characteristics and attributes that may be summarized as follows:

1. **Budget formulas are complex.** Formulas calculate separately the resource requirements of each generally recognized functional area of institutional activity within the education and general (E & G) budget. These areas consist of the following:

   Instruction
   Academic support (including libraries)
   Organized research
   Public service
   Student services
   Physical plant operation and maintenance
   Institutional support

However, most states limit formula calculation to determining the resource requirements of (a) instruction, (b) libraries, (c) student services, (d) physical plant operation and maintenance, and (e) institutional support.

2. **Budget formulas recognize few base factors.** Most formulas restrict base factors (institutional need predictors) to enrollment attributes such as student credit hours, student FTEs, student headcount, and continuing education units, or to physical plant characteristics such as square feet of building space and acres of ground. Base factors recognized tend to represent *input* measures of effort or indicators of magnitude rather than actual *outputs*, and no provision for quality measures exists.

3. **Budget formulas utilize one or more of three computational methods.** A study conducted by the author in 1973—and summarized (Gross, 1973)—found three basic computational methodologies present in each of twenty-five formulas in use at that time. An analysis of the formulas used by states in 1977 indicated no substantive deviation from those methods, which were:

   a) *Rate per base factor unit (RBFU)*—where given rates (formula factors) are multiplied by institutional descriptors (base factors) to calculate resource requirements. An example would be to multiply student credit hours by fixed dollar rates.

   b) *Base factor position ratio with salary rates (BFPR/SR)*—where given position ratios (faculty/student, faculty/

supporting staff, etc.) are used to determine justified FTE positions which, in turn, are multiplied by given average salary rates to calculate resource requirements. An example of the BFPR/SR method would be to divide FTE enrollment by 20 (faculty/student ratio) to obtain the number of FTE faculty positions justified and then to multiply the number of faculty positions by a given salary rate to obtain the total instructional salary budget request.

c) *Percentage of base factor (PBF)*—which represents the most simple formula application in that the resource requirement of a given functional area is expressed as a percent of the total amount calculated for another functional area. For example, institutional support might be limited to twelve percent of the total instructional budget request.

4. **Budget formulas are zero based.** Most budget formulas follow a zero-base approach whereby the total appropriation request is developed anew each year using quantitative institutional base factors. Thus, fewer students in a given year could result in fewer dollars for the appropriation base budget—as opposed to fewer new dollars over last year's appropriation if incremental budgeting were followed.

5. **Budget formulas lack differentiation among institutions.** Because budget formulas were designed to ensure the distribution of state funds to institutions on an equitable and objective basis, little leeway is possible for the recognition of differences in institutional roles or missions. At best, some formulas differentiate between types of institutions (community colleges, regional universities, and comprehensive universities) by using different formula factors (rates, ratios, percentages) for each type. Most formula states are content to fund alike similar programs at similar levels of instruction. (Of course, different credit hour mixes among levels and disciplines result in *de-facto* funding distinctions among institutions, but such distinctions may be detrimental to, rather than supportative of, individual institutional missions.)

6. **Budget formulas assume linear relationships between base factors and resource requirements.** Most formula factors such as rates per credit hour are derived from institutional cost studies and reflect statewide average costs per unit. When applied to base factors, these averages (which represent only what was, at some earlier time, under certain conditions) predict resource requirements in a linear fashion.

7. **Formula budgeting is more prevalent than formula funding.** Formulas are used more to *develop* appropriation requests of colleges and universities than to *allocate* state funds to individual institutions. In good tax receipt years, some states fund fully the formula-derived requests for higher education. Others are selective as to which institutions receive full formula funding. However, in many formula states, the formula-derived request represents only the starting point in the appropriation process. (In Tennessee, for example, a formula is used to calculate a base appropriation request to which the Tennessee Higher Education Commission adds an amount for salary increases and to compensate for inflation. This higher figure becomes the recommended request for each institution. Because state revenues generally do not keep up with inflation, and/or funding requests for other state services are given higher priority, the request for each institution is proportionally scaled back to make the total for higher education "fit" the state resources deemed available. Thus, each institution actually receives a pro rata share of its original formula-derived request. This practice has been followed for the past eight years.)

Formula Budgeting is Alive and Well in Twenty-Two States

From a meager beginning in 1951 in four states (California, Indiana, Oklahoma, and Texas), budget formulas have proliferated and spread to states in all regions of the country. In 1973 (Gross), a total of twenty-five states were identified as using formulas. A study performed in 1977 by the Kentucky Council on Higher Education found the number to be twenty-two. Whereas no single source gives a chronological account of budget formula development on a state-by-state basis, trends in formula adoption or rejection may be gleaned from the few nationwide studies performed during this period. Table 1 presents the extent to which budget formulas were in use by states during five of the past twenty-eight years.

Table 1
Budget Formula Utilization by States

State	1951[a]	1963[a]	1967[a]	1973[a]	1977[b]
Alabama			X	X	X
Alaska					X
Arkansas				X	X
California	X	X	X		
Colorado				X	
Connecticut			X		
Florida		X	X	X	X
Georgia				X	X
Illinois			X		
Indiana	X		X		
Kentucky		X	X		
Louisiana			X	X	X
Maryland				X	
Minnesota			X	X	
Mississippi			X	X	X
Missouri				X	X
Nevada				X	X
New Jersey				X	X
New Mexico			X		X
New York				X	X
North Dakota			X	X	X
Ohio				X	X
Oklahoma	X	X	X	X	
Oregon			X		
Pennsylvania				X	
South Carolina				X	X
South Dakota				X	X
Tennessee		X	X	X	X
Texas	X	X	X	X	X
Virginia				X	X
Washington				X	X
West Virginia				X	X
Wisconsin				X	X
Totals	4	6	16	25	22

[a]Francis M. Gross, "A Comparative Analysis of the Existing Budget Formulas Used for Justifying Budget Requests or Allocating Funds for the Operating Expenses of State-Supported Colleges and Universities." The University of Tennessee, 1973.

[b]Kentucky Council on Higher Education, "Program Funding by Formula of the Unrestricted Current Fund Operations of Kentucky's Public Higher Education Institutions," Frankfort, July, 1977.

A comparison between the states using formulas in 1973 and those using formulas in 1977 reveals that two states (Alaska and New Mexico) are newcomers to the formula ranks while five states (Colorado, Maryland, Minnesota, Oklahoma, and Pennsylvania) have, for various reasons, abandoned formulas and adopted other methodologies for determining state appropriations for higher education. However, the most recent study (Kentucky Council on Higher Education, 1977) reported that, in addition to the twenty-two states found to be using formulas in 1977, others were in various stages of formula development or abandonment:

> Florida and Wisconsin are resuming formula funding after a two-year hiatus respectively. Nevada and Alaska are presently expanding their formulas to include additional

> institutional activities. In addition, Kentucky, Kansas, and Utah are actively pursuing formula development while Connecticut and Colorado are proceeding at a more measured pace. Michigan's state legislature rejected a formula-funding mechanism for that state. Oregon, Illinois, and California are using limited techniques for their community college systems, and numerous other states are interested and have made requests for copies of anything produced by Kentucky. p. 32

An examination of the differences between the formulas used by the twenty-two states in 1977 and the twenty-five states in 1973 indicates no definite trends in computational method changes for calculating resource requirements of various functional areas during the four-year interval. (See Table 2.)

Table 3 presents the institutional base factors that were used by states in 1977 as resource predictors for each functional area. Enrollment (credit hours, FTE students, and headcount) remains the most used predictor for estimating the resource requirements of instruction, libraries, students' services, and organized research. Seven states used enrollment for calculating institutional support, while seven others used a percentage of the total instructional or total educational and general budget. Square feet of building space was clearly the most favored choice for predicting physical plant operation and maintenance cost requirements.

From a geographical standpoint, formula budgeting remains the most prevalent approach in the South where ten of the twenty-two states were located. The other formula states were divided among the Midwest (four), the Southwest (two), the Farwest (two, counting Alaska), the Mideast (two), and the Northeast (two). These groupings suggest that budget formulas are most likely to be adopted by states having either limited resources to commit to higher education or a large number of similar institutions vying for state dollars.

Another interesting observation is that, among the forty-three institutions identified in the Ladd/Lipsett survey (1979) as having the top-ranked faculties (departments) in nineteen fields of study, only six were state institutions subject to formula budgeting. Located in five formula states, the six state institutions accounted for nineteen (9.3 %) of the top-ranked departments. (However, the University of Wisconsin, Madison, accounted for twelve departments.) In sharp contrast, eighteen state institutions located in non-formula states had seventy-two (35.1%) of the top-ranked departments. (Nineteen private institutions accounted for the remaining 55.6% of the top-rated departments.)

Formula Pitfalls in the Eighties

The problems facing higher education in the 1980s have, for the most part, been revealed in numerous publications and remain the focal point of many professional conferences. In a recent publication, the Southern Regional Education Board (1978) identified several trends which will impact on colleges and universities in the future:

1. *Changing student body composition* with a reduction in the traditional college-age, full-time student and an increase in the number of older part-time students. Although student headcounts may stabilize, reductions in full-time equivalent student enrollments will be experienced by many institutions.

2. *Selective growth and retrenchment* within and among

Table 2
Formula Calculation Methods Used by States in 1973 and 1977

Functional Budget Areas	Calculation Methods: RBFU[1] 1973	RBFU[1] 1977	PBF[2] 1973	PBF[2] 1977	BFPR/SR[3] 1973	BFPR/SR[3] 1977
Instruction	13	7	10	3	17	9
Libraries	12	11	16	8	8	5
Student services	6	7	2	5	1	1
Organized research	0	3	3	2	0	5
Public service[4]		1		3		1
Physical plant	11	7	11	3	4	3
Institutional support	8	5	11	8	1	1

1. RBFU is the rate per base factor unit method.
2. PBF is the percentage of base factor method.
3. BFPR/SR is the base factor position ratio with salary rates method.
4. Public service was not a separate functional area in 1973.

Table 3
Formula Base Factors Used by States in Determining Resource Requirements for Functional Budget Areas in 1977

Functional Budget Area	Head Count	FTE[1] Students	Credit Hours	Faculty Positions	E & G Budget[2]	Square Feet
Instruction		2	13			
Libraries		3	7		6	
Student services	5	3	2		5	
Organized research		1	6	1	1	
Public service		1		1	2	
Physical plant					2	9
Institutional support	2	3	2		7	

1. Full-time equivalent
2. Educational and General

institutions which reflects not only the change in student body compositions but also the changing curricular preferences of students.

3. *Rising costs* stemming from both inflation and the inability of colleges and universities to increase productivity sufficiently to offset increases in salaries and benefits. These, coupled with stabilized or reduced enrollments, mandatory social programs, the need for more remedial instruction, and more student support activities such as financial aid programs, cause the average instructional cost per full-time student to rise rapidly.

4. *Increasing governmental involvement* reflected in the increased monitoring of all operations of higher education by both the legislative and executive branches of state governments as well as increasing federal legislation affecting higher education.

5. *More "Proposition 13" type referenda* which impose limitations on personal property taxes and other tax sources and thus curtail state resources available for public services, including higher education.

6. *Increasing competition with other state agencies* for limited funds which, when combined with the perception of a declining economic value of a college education, may result in higher education becoming more of a discretionary item in state budgets and receiving a smaller proportion of new state dollars.

These trends, when viewed in a formula-budgeting context, pose serious problems for state-supported colleges and universities. Specifically, formula developers must start to give their utmost attention to such pitfalls as (a) the linear cost syndrome, (b) the self-fulfilling average cost prophecy, and (c) the formula numbers game.

The Linear Cost Syndrome

Most college presidents and budget officers in formula states are acutely aware that during steady-state or declining enrollment periods, enrollment-driven formulas have an adverse effect on state appropriations for higher education. While instructional and institutional costs do not rise proportionally to enrollment increases, linear relationships between costs and most formula factors (e.g., enrollments) have been accepted by the higher education officials in the development of budget formulas. This probably occurred for two reasons: (1) average costs per student, per credit hour, or per square foot of building space were relatively easy to obtain and (2) the linear approach represented a "margin of safety" for institutions when state appropriations failed to keep pace with enrollment increases. Since more states practice formula budgeting than formula funding, linear relationships have helped ease the burden of less-than-full-formula funding by providing new funds to help meet the marginal costs associated with the numbers of new students. Linear formula relationships have also helped offset the impact of modifications in formula factors such as increasing faculty/student ratios or holding down the rates per credit hour so as to keep formula-generated requests in line with anticipated state revenues.

During declining enrollment periods, however, linear formulas can be devastating—particularly when state legislatures do not fully fund formula requests. In declining enrollment periods, institutions can only achieve marginal reductions in expenditures, and the amount of such reductions is contingent upon many factors. Required courses and key electives must continue to be taught, albeit to fewer students. "Critical mass" staffing requirements and the maintenance of specializations within academic areas prevent a reduction in instructional staff parallel to the decline in enrollment. When staff reductions do occur, tenure policies require the termination of teaching assistants, part-time staff, and untenured faculty first. Since the untenured appointments are at the lower end of the salary scales, the resulting cost reductions do not correspond to funding reductions based on average costs. The result will likely be as Moss and Gaither (1976) have predicted:

> In a labor intensive effort such as higher education, which may be a constant productivity industry, where up to three-fourths of an institution's operating budget may go for salaries, it is not clear how much resource reduction can be absorbed before long-term institutional damage occurs. (It follows that) . . . quality will inevitably suffer once funding reductions pass the average cost curve for constant program quality since below this point the costs are higher than the resources allotted. p. 558

The Self-Fulfilling Average Cost Prophecy

Another formula pitfall whose impact will manifest itself fully during a period of steady-state or declining enrollments is the self-fulfilling average cost prophecy. This phenomenon will occur in those states which derive formula factors from statewide average costs updated periodically by institutional cost studies. The rationale for this practice is to satisfy the equity principle of formula funding by providing equal financial funding treatment for all similar programs in every institution. When combined with the practice of deducting fees and all other unrestricted revenues to arrive at the net state appropriation request, the formula becomes an expenditure-leveling device since the statewide average formula rates determine the maximum budget at which each institution is expected to operate. During periods of enrollment growth, this leveling tendency can be circumvented by the internal reallocation of new dollars over the base budget. But during stable or declining enrollment periods, when appropriation increases are few or nonexistent, internal reallocation becomes more difficult. Consequently, the demand for internal institutional budgeting to parallel actual state funding intensifies and the outcome frequently may be to let the formula dictate cost reductions within institutions. Thus, the self-fulfilling average cost prophecy will be realized.

The Formula Numbers Game

Last, but not least, among formula pitfalls is the "numbers game" which is spawned by enrollment-driven formulas. Whereas competition for students was an acceptable alternative to the political warfare and intensive lobbying which precluded the adoption of budget formulas in many states, the rapid increase in enrollments at state institutions during the 1950s, 1960s, and early 1970s all but eliminated the need for anything other than passive recruitment efforts. Aggressive recruitment was left to the small private colleges whose survival depended upon finding a clientele for the special services and educational programs which set them apart from the less expensive and more accessible state institutions.

However, changing enrollment patterns in the late 1970s, along with predictions for declining numbers of college-age students in the 1980s, have brought about the development of intensive recruitment programs by state institutions. Although not as experienced in the recruitment and retention of students as their counterparts in private colleges and universities, officials in state-supported institutions are rapidly gaining the expertise for marketing the services of higher education. Currently, state institutions are at various stages of preparation for the intensive recruitment efforts to improve, or at least retain, their share of the declining potential enrollment base during the next decade.

Faced with funding reductions proportional to enrollment declines, the temptation to take drastic measures to avoid the dreaded "financial exigency" process will intensify in the 1980s. Such pressure on faculty and administrators will likely promote practices which the Carnegie Council on Policy Studies in Higher Education (Scully, 1979) has termed "ethically dubious, if not illegal" and will compromise the integrity and lead to the deterioration of higher education. Specifically, the practices which the Carnegie Council fears are already present in post-secondary education are:

1. The proliferation of off-campus programs of dubious quality
2. The lowering of admission and retention standards
3. "Hucksterism" in the recruitment of nontraditional and foreign students
4. The deliberate recruitment and admission of students lacking in basic skills
5. Grade inflation and the lowering of academic standards.

In addition to the practices identified by the Carnegie Council, there are also periodic reports of the falsification of enrollment reports, the reclassification of courses, the permitting of course overloads during enrollment projections periods, and other actions which serve to improve formula-derived appropriation requests.

Unfortunately, there are no winners in the formula numbers game. Whether institutions experience severe underfunding or resort to unethical practices in order to play the numbers game, the quality of educational programs suffers. Deterioration of educational quality will only result in the lessening of the economic value of the college degree which, in turn, will erode public support and, ultimately, funding priority for the services of higher education. The end result could likely be economic disaster as well as the complete loss of institutional autonomy for state institutions.

Alternatives to Formula Pitfalls

The probability of reduced enrollments, rising costs, greater competition for fewer students, greater competition for fewer state resources, and more governmental involvement is high. For the same reasons, an increase is also likely in the number of states utilizing budget formulas. If the erosion in the quality of higher education is to be minimal, the challenge will be to recognize the pitfalls of current formula practices and seek alternative funding approaches.

Obviously, much study in developing new formula or non-formula approaches is needed. One of the more obvious solutions to the linear cost syndrome is to substitute marginal for average costs as formula factors. However, this is not easily accomplished. Marginal costs are difficult to calculate and tend to reflect the unique structure of each institution. Conversely, marginal costs among different size institutions will likely bear little resemblance to each other. Perhaps the best that can be expected is to calculate average marginal costs per base factor for formula application in two ways: (1) use marginal cost information to develop economies (and, if applicable, diseconomies) of scale factors for incorporation into every enrollment-driven formula, and (2) limit formula application to incremental budgeting based on marginal costs. If the use of marginal costs is not feasible or is impractical because of institutional differences or because costing methods have not been fully perfected, there are other stop-gap measures that should be considered.

First, modify budget formulas to limit revenue deductions to student tuition and fee receipts. This action will change the complexion of many formulas from educational expenditure-equalizing devices to mechanisms for providing equal state support to similar programs. Millett (1974), in addressing this problem, has stated:

> My sense of the need for equity is satisfied by a formula that results in an equality of appropriation support for instruction based on two and only two sources of income: the state government general appropriation for departmental instruction and institutional support plus the general institutional charge to all students. All other sources of outside income then become add-on for the benefit of the individual state institution of higher education which happens to generate this additional income. p. 60

Second, eliminate the use of historical average costs as formula factors to predict future resource requirements. For states which average the costs of all institutions regardless of size or type, consideration should be given to determining separate cost rates for community colleges, regional universities, and major research universities—or any other logical division which best represents the higher education divisions within a particular state. A more complex but intriguing approach is to use historical cost data to develop cost indices which reflect the relative costs of instruction among academic programs, levels of instruction, and types of institutions. These indices could be used to weight projected enrollments by discipline and level of instruction to arrive at total institutional base factors (e.g., weighted credit hours). This approach would more nearly reflect the complexity and uniqueness of each institution. Total institutional base factor units could then be multiplied by given formula rates (perhaps different for each type of institution) adjusted annually for inflation. Variations of this approach are evident in those states using indices to weight credit hours and those using benchmark salary rates which reflect regional averages. Adoption of these approaches should help prevent realization of the self-fulfilling average cost prophecy.

The use of formulas during periods of steady or declining enrollments will always promote the formula numbers game unless funding approaches can be found which remove enrollment attributes as institutional resource predictors. One approach would be for state governing or coordinating boards to conduct extensive enrollment projection studies by institutional service region and then set maximum and minimum enrollment ranges for each college or university within which state funding would be fixed. Ranges should be wide enough to encompass enrollment fluctuations expected during five-year intervals. This practice would limit enrollment change rewards to increases or decreases in actual fee collections, which within certain ranges may approximate the actual increases or decreases in marginal costs. Removing state funding rewards for intensive recruitment and cushioning institutions against drastic funding reductions should enable colleges and universities to reallocate funds internally to help combat the effects of inflation on academic operating budgets and stem the erosion of academic standards.

Finally, viable non-formula approaches should be given consideration by formula states. Illinois has adopted an objective form of incremental program budgeting which appears to incorporate the positive aspects of formula budgets while minimizing the formula pitfalls previously discussed. In that state, future appropriation requests for state institutions of higher education are derived by adjusting the projected expenditures for the current year for increases or decreases in marginal costs and tuition revenue based on enrollments and then adding increases for salaries, operating budgets, utilities, library material costs, new building maintenance costs, and program support (Illinois Board of Higher Education, 1979). The program support feature in the appropriation request enables institutions to (a) adjust for shifts in student curricular demands, (b) respond to social and economic needs, (c) improve the quality of instruction, (d) enhance faculty development, and (e) initiate new, or reorient current, program directions—all of which represent the programmatic flexibility that colleges and universities need in order to adjust effectively to the changes in higher education.

Summary

Formula budgeting in the financing of public higher education has yet to attain its potential as a predictor of resource requirements. While the use of formulas during the growth period of the last two decades may have been a temporary panacea for the funding problems of state-supported institutions, continued reliance upon budget formulas as they now exist may prove to be public higher education's nemesis during the no-growth or declining periods ahead. The real test for the medicinal utility of budget formulas will be in their application to accommodate the major trends of the 1980s and their ability to preserve the quality of public higher education and the existence of the state institutions under their purview.

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